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1 Courses: State of the art in interactive ray tracing

Peter Shirley

July 2006 Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06
Publisher: ACM Press

 Full text available: [pdf\(14.08 MB\)](#) Additional Information: [full citation](#), [abstract](#)

Recent improvements in computer hardware have allowed ray tracing to be used in some interactive applications. The trends in architecture and expansions of geometric model should increase the use of interactive ray tracing. This course presents recent and often not-yet published work on interactive ray tracing.

2 Courses: An introduction to sketch-based interfaces

Joseph LaViola, Randall Davis, Takeo Igarashi

July 2006 Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06
Publisher: ACM Press

 Full text available: [pdf\(31.58 MB\)](#) Additional Information: [full citation](#), [abstract](#)

Sketch-based interfaces are a natural, pencil-and-paper-like approach to interacting with a variety of applications, including conceptual modeling, animation, and note-taking systems. This course offers an in-depth discussion of sketch-based interface design, ranging from simple gestural commands to complex sketch-understanding systems. Attendees will learn how these interfaces are designed and how to develop their own.

3 GPGPU: general purpose computation on graphics hardware

David Luebke, Mark Harris, Jens Krüger, Tim Purcell, Naga Govindaraju, Ian Buck, Cliff Woolley, Aaron Lefohn

August 2004 ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04
Publisher: ACM Press

 Full text available: [pdf\(63.03 MB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#)

The graphics processor (GPU) on today's commodity video cards has evolved into an extremely powerful and flexible processor. The latest graphics architectures provide tremendous memory bandwidth and computational horsepower, with fully programmable vertex and pixel processing units that support vector operations up to full IEEE floating point precision. High level languages have emerged for graphics hardware, making this computational power accessible. Architecturally, GPUs are highly parallel s...

4 The elements of nature: interactive and realistic techniques

 Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf
August 2004 ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04

Publisher: ACM PressFull text available:  pdf(17.65 MB) Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics hardware-based simulation techniques and the latest physics-based simulation techni ...

5 Courses: Exploiting perception in high-fidelity virtual environments

 Mashhuda Glencross, Alan G. Chalmers, Ming C. Lin, Miguel A. Otaduy, Diego Gutierrez
July 2006 Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06

Publisher: ACM PressFull text available:  pdf(5.25 MB) Additional Information: [full citation](#), [abstract](#)

This course introduces high-fidelity virtual environments and explains the key components required to build compelling environments. Then it details perceptually inspired techniques that facilitate high-fidelity rendering, collaboration, and complex interaction in these virtual environments. Particular emphasis is placed on real applications, with several live demonstrations.

6 Level set and PDE methods for computer graphics

 David Breen, Ron Fedkiw, Ken Museth, Stanley Osher, Guillermo Sapiro, Ross Whitaker
August 2004 ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04

Publisher: ACM PressFull text available:  pdf(17.07 MB) Additional Information: [full citation](#), [abstract](#), [citations](#)

Level set methods, an important class of partial differential equation (PDE) methods, define dynamic surfaces implicitly as the level set (iso-surface) of a sampled, evolving nD function. The course begins with preparatory material that introduces the concept of using partial differential equations to solve problems in computer graphics, geometric modeling and computer vision. This will include the structure and behavior of several different types of differential equations, e.g. the level set eq ...

7 What every computer scientist should know about floating-point arithmetic

 David Goldberg
March 1991 ACM Computing Surveys (CSUR), Volume 23 Issue 1

Publisher: ACM PressFull text available:  pdf(3.82 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Floating-point arithmetic is considered as esoteric subject by many people. This is rather surprising, because floating-point is ubiquitous in computer systems: Almost every language has a floating-point datatype; computers from PCs to supercomputers have floating-point accelerators; most compilers will be called upon to compile floating-point algorithms from time to time; and virtually every operating system must respond to floating-point exceptions such as overflow. This paper presents a ...

Keywords: NaN, denormalized number, exception, floating-point, floating-point standard, gradual underflow, guard digit, overflow, relative error, rounding error, rounding mode, ulp, underflow

8 Real-time shading

 Marc Olano, Kurt Akeley, John C. Hart, Wolfgang Heidrich, Michael McCool, Jason L. Mitchell, Randi Rost

August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

Publisher: ACM Press

Full text available:  pdf(7.39 MB) Additional Information: [full citation](#), [abstract](#)

Real-time procedural shading was once seen as a distant dream. When the first version of this course was offered four years ago, real-time shading was possible, but only with one-of-a-kind hardware or by combining the effects of tens to hundreds of rendering passes. Today, almost every new computer comes with graphics hardware capable of interactively executing shaders of thousands to tens of thousands of instructions. This course has been redesigned to address today's real-time shading capabili ...

9 Sifting out the mud: low level C++ code reuse

 Bjorn De Sutter, Bruno De Bus, Koen De Bosschere

November 2002 **ACM SIGPLAN Notices , Proceedings of the 17th ACM SIGPLAN conference on Object-oriented programming, systems, languages, and applications OOPSLA '02**, Volume 37 Issue 11

Publisher: ACM Press

Full text available:  pdf(1.35 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

More and more computers are being incorporated in devices where the available amount of memory is limited. This contrasts with the increasing need for additional functionality and the need for rapid application development. While object-oriented programming languages, providing mechanisms such as inheritance and templates, allow fast development of complex applications, they have a detrimental effect on program size. This paper introduces new techniques to reuse the code of whole procedures at t ...

Keywords: code compaction, code size reduction

10 Courses: Performance-driven facial animation

 Fred Pighin, J. P. Lewis , George Borshukov , Chris Bregler , Parag Haveldar , Thomas Kang , Jim Radford , Mark Sagar , Steve Sullivan , Tom Tolles , Li Zhang

July 2006 **Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06**

Publisher: ACM Press

Full text available:  pdf(34.74 MB) Additional Information: [full citation](#), [abstract](#)

Performance-driven facial animation (PDFA) has recently been adopted in a number of important entertainment projects. This course describes tracking, cross mapping, and model derivation technologies used in PDFA, and summarizes unresolved issues. Leading researchers and industry specialists present current and forthcoming motion-capture techniques, cross-mapping technologies, and application case studies from important recent and current projects.

11 Simplify: a theorem prover for program checking

 David Detlefs, Greg Nelson, James B. Saxe

May 2005 **Journal of the ACM (JACM)**, Volume 52 Issue 3

Publisher: ACM Press

Full text available:  pdf(1.93 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This article provides a detailed description of the automatic theorem prover Simplify, which is the proof engine of the Extended Static Checkers ESC/Java and ESC/Modula-3. Simplify uses the Nelson--Oppen method to combine decision procedures for several

important theories, and also employs a matcher to reason about quantifiers. Instead of conventional matching in a term DAG, Simplify matches up to equivalence in an E-graph, which detects many relevant pattern instances that would be missed by th ...

Keywords: Theorem proving, decision procedures, program checking

12 Collision detection and proximity queries

 Sunil Hadap, Dave Eberle, Pascal Volino, Ming C. Lin, Stephane Redon, Christer Ericson
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

Publisher: ACM Press

Full text available:  pdf(11.22 MB) Additional Information: [full citation](#), [abstract](#)

This course will primarily cover widely accepted and proved methodologies in collision detection. In addition more advanced or recent topics such as continuous collision detection, ADFs, and using graphics hardware will be introduced. When appropriate the methods discussed will be tied to familiar applications such as rigid body and cloth simulation, and will be compared. The course is a good overview for those developing applications in physically based modeling, VR, haptics, and robotics.

13 Compiling Fortran D for MIMD distributed-memory machines

 Seema Hiranandani, Ken Kennedy, Chau-Wen Tseng
August 1992 **Communications of the ACM**, Volume 35 Issue 8

Publisher: ACM Press

Full text available:  pdf(5.38 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

Keywords: Fortran D, concurrent languages, distributed languages, distributed programming, parallel languages, parallel programming

14 Courses: Geometric modeling based on triangle meshes

 Mario Botsch, Mark Pauly, Christian Rössl, Stephan Bischoff, Leif Kobbelt
July 2006 **Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06**

Publisher: ACM Press

Full text available:  pdf(24.64 MB) Additional Information: [full citation](#), [abstract](#)

This course is designed to cover the entire geometry processing pipeline based on triangle meshes. Speakers present the latest concepts for mesh generation and mesh repair; geometry and topology optimizations like mesh smoothing, decimation, and remeshing; and parametrization, segmentation, and shape editing. In addition to describing and discussing the related algorithms, the course provides valuable implementation hints and source code for most of the covered topics.

15 High dynamic range imaging

 Paul Debevec, Erik Reinhard, Greg Ward, Sumanta Pattanaik
August 2004 **ACM SIGGRAPH 2004 Course Notes SIGGRAPH '04**

Publisher: ACM Press

Full text available:  pdf(20.22 MB) Additional Information: [full citation](#), [abstract](#)

Current display devices can display only a limited range of contrast and colors, which is one of the main reasons that most image acquisition, processing, and display techniques use no more than eight bits per color channel. This course outlines recent advances in high-dynamic-range imaging, from capture to display, that remove this restriction,

thereby enabling images to represent the color gamut and dynamic range of the original scene rather than the limited subspace imposed by current monitor ...

16 ABCD: eliminating array bounds checks on demand

Rastislav Bodík, Rajiv Gupta, Vivek Sarkar
May 2000 **ACM SIGPLAN Notices , Proceedings of the ACM SIGPLAN 2000 conference on Programming language design and implementation PLDI '00**, Volume 35 Issue 5

Publisher: ACM Press

Full text available:  pdf(306.96 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

To guarantee typesafe execution, Java and other strongly typed languages require bounds checking of array accesses. Because array-bounds checks may raise exceptions, they block code motion of instructions with side effects, thus preventing many useful code optimizations, such as partial redundancy elimination or instruction scheduling of memory operations. Furthermore, because it is not expressible at bytecode level, the elimination of bounds checks can only be performed at run time ...

17 Courses: Spatial augmented reality

Oliver Bimber, Ramesh Raskar
July 2006 **Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06**

Publisher: ACM Press

Full text available:  pdf(22.57 MB) Additional Information: [full citation](#), [abstract](#)

A survey of the latest techniques for augmented reality, which go beyond conventional head-mounted displays. The tutorial introduces prototypes, explains rendering and calibration algorithms, discusses case studies, and presents practical experience. Attendees learn about new applications enabled by current augmented-reality techniques that combine the real and virtual worlds in art, science, education, and industry.

18 Courses: Interactive shape editing

Marc Alexa
July 2006 **Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06**

Publisher: ACM Press

Full text available:  pdf(11.32 MB) Additional Information: [full citation](#), [abstract](#)

The state of the art in digital modeling techniques, both in commercial software and academic research. The goal of this course is to give attendees an understanding of the big open questions and the skills to engineer recent research in interactive shape-modeling applications.

19 Fast detection of communication patterns in distributed executions

Thomas Kunz, Michiel F. H. Seuren

November 1997 **Proceedings of the 1997 conference of the Centre for Advanced Studies on Collaborative research**

Publisher: IBM Press

Full text available:  pdf(4.21 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Understanding distributed applications is a tedious and difficult task. Visualizations based on process-time diagrams are often used to obtain a better understanding of the execution of the application. The visualization tool we use is Poet, an event tracer developed at the University of Waterloo. However, these diagrams are often very complex and do not provide the user with the desired overview of the application. In our experience, such tools display repeated occurrences of non-trivial commun ...

20 Courses: High-dynamic-range imaging: theory and applications

 Paul Debevec, Erik Reinhard

July 2006 **Material presented at the ACM SIGGRAPH 2006 conference SIGGRAPH '06**



Publisher: ACM Press

Full text available:  [pdf\(15.18 MB\)](#) Additional Information: [full citation](#), [abstract](#)

New techniques in capturing, representing, processing, and displaying high-dynamic-range (HDR) images. HDR imagery represents the full range of light in the real world, which enables marked improvements in visual fidelity and photorealism. Application areas include lighting, compositing, film, game design, and display hardware.

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